

## Virginia No-Till Fact Sheet Series Number Three: Manure Injection

*Rory Maguire, Professor and Extension Specialist, School of Plant and Environmental Sciences*  
*Timothy Woodward, Research Specialist, School of Plant and Environmental Sciences*

### What does manure injection mean?

In Virginia liquid dairy and swine waste are typically surface applied to soils. Traditionally, the only way to get manure below the soil surface has been through tillage, but this is not compatible with no-till systems. However, there are several new technologies available to directly inject manure below the soil surface, such as the disk injection system in the photograph below. There are several other types of implements that can inject manure, such as those that use chisels instead of disks to open the injection slit, and aerators that help manure infiltration. Currently there is only technology available for the injection of liquid manures that can be pumped, although technology is being developed to inject poultry litter.



Photograph of one type of liquid manure injection system currently available.

### Why would you want to inject manure?

#### *Benefits of manure injection*

The agronomic benefits of manure injection are mostly associated with greatly improved N use efficiency. Surface application of manure results in losses of ammonia-N through volatilization, while manure injection drastically reduces or eliminates these losses. For example, consider applying liquid dairy manure with an average analysis in the spring for a following corn crop, and how much plant available N (PAN) this would supply. A surface application would supply about 6 lb PAN/1000gal,

while if this manure were injected it would supply about 12 lb PAN/1000gal. This is about twice as much PAN which means farmers are getting much more value out of the N in manure. The price of N fertilizer has been fluctuating greatly, but at 70 ¢/lb of N, the added value of injecting manure =  $6 \times 0.70 = \$4.20/1000 \text{ gal}$ . **If 8000 gal typical dairy slurry are applied to an acre, injection will lead to an extra 48 lb N/acre, which is about a \$33.60 value. If a farmer injects 500,000 gal of dairy manure, the increased value of this N would be about \$2,100.** Manure injection also greatly decreases odors during manure applications, which can decrease complaints from nearby home owners.

Manure injection also has environmental benefits, as surface applications of manure have been shown to increase N and P losses in runoff to rivers and streams, while injection places manure below the soil surface where it doesn't interact with runoff water during storms. Therefore manure injection decreases N and P losses in runoff and improves water quality. Tillage can prevent ammonia losses if done immediately after surface application of manure, but manure injection eliminates the need for this tillage and therefore assists in the implementation of no-till, which decreases nutrient and sediment erosion. The reduced ammonia volatilization associated with manure injection also directly impacts water quality, as approximately 6% of the N entering the Chesapeake Bay comes from direct deposition of atmospheric N such as ammonia.

#### *Potential drawbacks of manure injection*

Potential drawbacks involved with manure injection are increased costs and time. Producers should evaluate the extra costs and see if these can be recouped by the increased N recovery. The increased costs start with the necessary machinery. Currently, retrofitting an existing manure tanker as in the photograph above, would cost approximately \$17,000. This is for a 6 unit injector and additional injection units cost in the order of \$1,500. It is difficult to apply manure as quickly with manure injection equipment as it is to spray a wide swath from a tanker truck, so increased tractor and operator time is necessary. Extra energy is also necessary to cut the injection slit compared to surface applications, this increases diesel costs and may require a larger tractor. These extra costs will vary with availability, size and type of equipment.

There are several strategies to manage the increased costs associated with manure injection. Equipment could be used on several farms, decreasing the cost per farm. Another strategy is using nurse trucks to ferry manure back and forth between the injector and the slurry lagoon, to maximize the time the injector equipment spends in the field and minimize road time. If manure applications are to be conducted close to the lagoon, it may be possible to use a traveling hose system attached to the applicator rather than a tanker system.

#### **Is manure injection always consistent with no-till?**

Certain injection implements are compatible with no-till. However, as the precise definition of no-till varies by agency, there is some gray area between what is and is not compatible. Less aggressive implements, such as the disk injector in the photograph above, are considered compatible. Implement characteristics such as spacing of injection bands, amount of soil disturbance and residue cover all affect whether or not manure injection will be allowable under the definition of no-tillage used by various agencies. If you receive cost share for no-till, check with the agency providing it.